

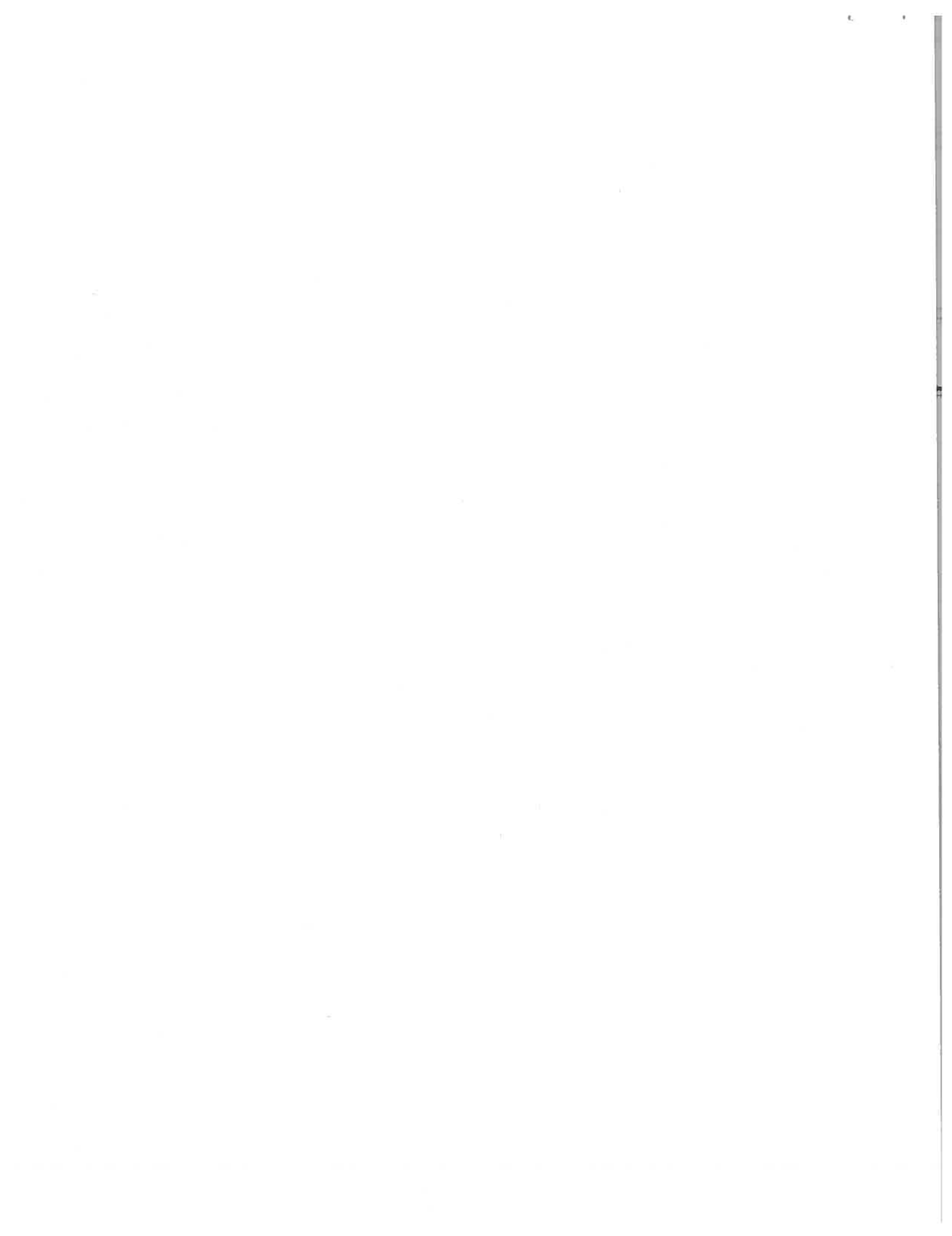
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COMMUNICATION IN HISTORY:
THE ROLE OF SCIENCE

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A BRIDGE FOR THE PRESENT CRISIS IN CULTURE AND SOCIETY

The tumultuous cultural evolution that occurred in many western countries in the Sixties has provoked a critical reaction towards the function and the role of scientists and of science in today's world. We are obviously referring to those countries in which there is still the freedom of discussing and publishing what one wants, since if in nations governed by dictatorships such a movement has existed or is developing now, it is certainly not been able to come out in broad daylight.

The criticism aimed at science from the outside, by exponents of the humanities, but also from the inside at the hand of some researchers especially young people who make a living from science, is built on two bases.

The first has an essentially cultural character, is free of hidden political motives, is stimulated by an honest quest for a humanistic unification of scientific activities and their technological applications; this is a criticism which in general comes from the end of the spectrum opposite to that, in which science is idolized, in which science is given erroneously (by writers and philosophers, and certainly not ^{by the} scientists) attributes of "superphilosophy" and "supermagic", capable of resolving all man's problems, including unhappiness and selfishness, as well as hunger and poverty. Forgetting that science, since Galileo Galilei founded it, is basically a methodology for the search for truth in the natural world, a certain confusion is made by including in the term "science" also technology, and when no distinction is made between basic research and applied science in considering scientific activity

the root of all good and all evil.

The positivist mood of the last century, which had established itself and had then spread itself following the first scientific-technological breakthroughs, has, in the present century, been strengthened by the progress achieved in the last decades, culminating in the *conquest* of the Moon. "If we are able to go to another planet, then we are certainly able to solve all of Earth's problems, including human and existential ones" : this was the leit-motiv of those who made science their idol. Since the end of the Sixties, many of them have been proposing the opposite view ; pointing to ecological degradation, pollution, poverty, social injustice and so on, they cry out that the cause of all humanity's plagues is this "art of devil" , the root of all evil.

The second framework within which the most violent criticism originates has a political character, and purely utilitarian aims. This is happening in many countries in Europe, especially in Italy, where the push to transform society in a communist direction is strongest ; according to Marxist ideology it is said that science is at the service of capitalism, that it is no neutral and so there is a capitalist and imperialist and therefore evil sort of science, and another kind of science, popular and therefore good : American, English or West German science is evil ; Soviet or Chinese, Cuban or Checkoslovakian science is good. School meeting and television debates are held concerning such arguments and hundreds of newspaper articles and dozens of books are thus written. And it seems impossible to make these people understand, even using the same parameters, that, if the atom bombs and missiles of the West are horribles means of destruction, the bombs and missiles of the Eastern block are certainly not good for the health. The unconfessed but evident

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motive of these increasingly insistent attacks - and I am still talking ^{about} Italy now - is very simple : to remove, by reducing it to mere applications, a cultural activity which escapes or can escape all ideological control, because it is based on pure rationality, on the iron law of experiment and on the not less stringent language of mathematics. Essentially what happened at the time of Galileo is now - mutatis mutandis - happening again : catholic philosophy could fight a fair battle against protestant ones, but found its weapon powerless when confronted with an activity such as scientific thinking which was and still is based on experimental results and mathematical logic : an activity for which no dogma or preconception can exist ; an activity able to destroy its own theories whenever experimental results require it, to the point that the French mathematician Poincaré was able to define science as "the graveyard of hypotheses" . These are the fundamental reasons for which science has been opposed since its birth by despotisms of all colours and all periods ; just to mention the most recent cases we may recall the treatment reserved by Hitler in Germany and by Stalin in the Soviet Union for scientists thought not to be ready to adapt themselves to the will of the despots, and it is not by coincidence that even now the most qualified movements upholding basic human rights, those rights which starting from freedom of thought are inseparable from the essence of man, find their origin in scientists.

Having said all this, I shall now turn from this second political framework of the present antiscientific campaign in some Western countries deal more profoundly with philosophers and politologists. My

interest lies in the analysis of the first framework, of the criticism which originates from humanists because of the fact that besides the reasons mentioned above, science - as we shall see better later on - has not generated culture, in spite of having generated much knowledge ; and then this criticism, or if you prefer this identity crisis, this crisis of roles and priorities is part of the crisis of contemporary society. And this forces us to meditate without preconceived ideas or dogmas, without political instrumentalizations of whatever sort. In the present technically developed world, the development of man can no longer be separated from scientific progress. [The growing need for science and technology seems an irreversible tendency because a return to the way of life of a hundred or more years ago is unimaginable to anybody. [On the other hand, though, the rising awareness in the more developed and freest countries together with the increasingly large participation of public funds necessary for certain scientific activities has caused the scientific world itself to question and establish what its role is and what functions it must take over and maintain. [The autonomy of science, as has been recently written by the Nobel Laureate Ilya Prigogine, this "absolute innocence" of the scientist who keeps himself out of the real problems of his time, would nowadays seem anachronistic or perhaps an excuse to escape his responsibilities. Such an attitude (the scientist in the ivory tower of his laboratory and his libraries) could be justified when scientific activity was nothing more than a cultural exercise and when the scientist lived on the fringes of society ; but nowadays scientific and technological dimensions are the very definition of what we consider to be civilization and western society. This is why the problem of science and society must now be posed in totally new terms, since it

has now become a fundamental question in today's world.

Therefore one can see that the problem of science and society must be formulated in absolutely new terms in as much as it has become a fundamental question of our contemporary world. It is no longer only a question of continuing the ancient debate between philosophers and scientists with the former trying to dictate to the latter and the indifference of the latter to the former. It is no longer only a question of the old polemic between spiritualists and materialists as when Diderot asked the scientists of his day to define the world and nature in such a way as to show that man belongs to nature and his thought is a product of organized and living matter. It is not only a question of taking note of the tragic conclusions of some modern biologists like Jacques Monod who are reduced to describing living beings as products of a succession of statistical factors and consequently to defining man as a stranger in the universe which accepts him with the same indifference as it admits any particular structure resulting from its general laws. It is not even a question of taking note of the protests against such a method of defining man and his problems (a method always attributed to scientists even if actually employed by philosophers), protests made very forcefully by thinkers from Kant, Hegel, Shelling Engels, Bergson and Whitehead and so on on to the present day.

Even if the present crisis has its origins directly in the factors described above and obviously in many others, when they wished to propose an alternative to positive science, saw their work become ridiculous and realized the sterility of their ideas with respect to the productive force of science, it is undeniable that their dissatisfactions and therefore their criticisms were valid. It is true that when Bergson and other philosophers attempted to criticize

Einstein on the basis of their philosophical arguments they were proved wrong by experimental physics.

You will recall the famous paradoxe of the twins vis-à-vis Einstein's ideas of space — time. One of the twins makes an interplanetary journey lasting many decades at almost the speed of light and remains young ; the other remains on the Earth and becomes old, which is absurd. Notwithstanding, the experiment was done, not with two flesh and blood twins, but with nuclear particles in an accelerator : time at the speed of light goes more slowly. Similar mistakes have been made by philosophers when - starting from the statement of quantum physics according which for certain subnuclear phenomena there can exist not a principle of cause and effect but a principle of probability - they have tried to say that this principle in a general sense should be considered obsolete. Obviously scientists and technologists too have made errors and false extrapolations. We may recall for example the claim made by some in recent years that they could imitate the activity of thought by means of computers. And it was not by chance that someone coined the phrase "artificial brain" or "artificial intelligence" when it was very easy to understand that human thought, (that is the most important and most difficult activity of which man is capable), is something much greater and very different from the computer's indeed complex but nevertheless mechanical powers of memorising and logical elaboration. In human history these mistakes have occurred, still occur and will certainly occur in the future. This is not important. What is important however is that because of this mode of reasoning the gap between the two cultures has widened to the point where any communication between the two sectors is completely impossible. The consequence has been the establishment of a scientific activity indifferent to human values and of humanistic disciplines

incapables of understanding what is happening in our world.

This is another cause of the present crisis which is not only cultural but also social, political and ethical. A crisis which penetrates the very roots of society and therefore the very values on which our civilization was firmly based.

Against this background we must express in new terms the relationship between science and humanist culture, science and philosophy.

But what are these relationships in new terms? First of all we must bear in mind that experimental science on the one hand and philosophy, theology and art (i.e. all the so-called humanities), on the other pursue different aims. The former directs itself towards knowledge of the natural world through investigation of phenomena which allow experiment in a precise "field of determination"; the humanities operate in sectors which are still to a large extent mysterious, and which will perhaps remain so for centuries to come or ever for ever. However, the one sector cannot and must not exclude the other and vice versa, because both are necessary complementary factors which make up the very human essence. The word "mystery" should not give cause for alarm if we remember that from the first moment the human race originated in mystery, and that in this state it has lived, is still living and will probably continue to live for ever. How many mysteries has science revealed? An enormous number. But every question answered has given rise to other more numerous and more difficult questions in a kind of endless race. Think of what is perhaps the greatest mystery for the human brain: knowledge of the brain itself. "We know - said the Nobel prize-winner John Eccles -

how a star is made, we understand the structure of the universe, we have quite profound knowledge of the atomic microcosm, but we know nothing or very little about how our own brain functions and acts. Science and the humanities, as I was saying earlier, are complementary ; indeed science, by its very nature, gives man the only form of truth ascertainable experimentally, but does not permit us to answer the fundamental "whys" about our existence. It only tells us how or clarifies relative "whys" ; never any of the absolute "whys" . Why does the universe exist ? Why does man exist ? Where do we come from ? Where are we going ?

In other words man in his brief life finds himself in a kind of train, and it is not possible—scientifically speaking—to know which station it left from or where it is going. We know a good deal about what happens in the course of the journey, but the termini are unknown. The humanities focus on these other kinds of spiritual and intellectual values. And even if the answers given by philosophy and theology are not provable in a concrete way, they still have an enormous value, if only in terms of hope and faith.

Today a civilized and developed human life is inconceivable without science and its benefits ; but a life without the contributions of the humanities would be equally inconceivable. A "technocratized" humanity would be a total disaster.

This having been said, the new relationship between science and society must consist of a total and reciprocal respect for the liberty, responsibility and knowledge of the scientist and at the same time for the responsibility and liberty of the humanist. The new relationship between science and society demands a science for man (not against or beyond him) ; but it also calls for a refoundation of ethics, of

philosophy and of many other humanist^{ie} disciplines; a refoundation which consists of taking into account what the scientific activity investigates and produces in terms of new knowledge and possibilities for practical application.

One method - perhaps the only one - at our disposal of achieving an aim of this kind is that of publishing our knowledge, and by this I mean the widest possible communication in society. Only in such a way not only the humanist but also the scientist and the public can be informed about what is produced in one field or the other. But this "publication" does not only mean popularisation, i.e. the reduction into simple language comprehensible to all of the problems and achievements of science, but also the transformation into simple terms of the achievements and concepts of philosophy, sociology etc.

If this work had been done in the past, humanity would probably have avoided many disasters. If, for example, it had been explained to people what the philosophical theories of a Nietzsche meant in practical terms (that is for the everyday life of individuals, families and peoples) ; if it had been explained that Hitler's political plan described in "Mein Kampf" was none other than the putting into practice of Nietzsche's ideas on the pre-eminence of the State over the individual and thence on the pre-eminence of Good States over Evil Nations, who knows whether Nazism and all that resulted from it would have taken hold in the Germany of the Thirties. Similar questions may be raised with reference to Stalinism and a thousand other events of human history. It goes without saying that this "publication" must be done in an honest and correct manner, that is it must not offend the truth or the ears of the public to whom it is addressed. It must be a two-way bridge of communication : a bridge to span the gulf between the two cultures

in order to re-establish the interrupted dialogue between the "clergymen" of science or of philosophy and the society, which should receive or undergo their works.

But obviously all these problems demand a separate discussion.